

WHAT IS CLAIMED IS:

1               1. A process for filling a trench of a semiconductor device, the method  
2 comprising:  
3               providing a semiconductor substrate;  
4               forming a silicon nitride layer on said semiconductor substrate;  
5               forming an oxide layer on said silicon nitride layer;  
6               partially removing said oxide layer, said silicon nitride layer and said  
7 semiconductor substrate to form at least one trench;  
8               forming a sacrificial oxide layer on sidewalls of said trench;  
9               removing said sacrificial oxide layer;  
10              performing an etching procedure to remove portions of said silicon nitride  
11 layer protruding from said sidewalls of said trench so as to form substantially even sidewalls  
12 of said trench; and  
13              forming a trench-fill layer to fill said trench and deposit on said oxide layer.

1               2. The process according to claim 1 wherein said etching procedure is a  
2 wet-etching procedure.

1               3. The process according to claim 2 wherein said wet-etching procedure  
2 is performed for about 100 to 200 seconds.

1               4. The process according to claim 2 wherein said wet-etching procedure  
2 is performed by an etchant with a selectivity of silicon nitride layer to oxide layer of at least  
3 about 10.

1               5. The process according to claim 4 wherein said etchant has a selectivity  
2 of silicon nitride layer to oxide layer ranging from about 50 to 100.

1               6. The process according to claim 5 wherein said etchant comprises a  
2 phosphoric acid solution.

1               7. The process according to claim 2 wherein said wet-etching procedure  
2 is performed at a temperature of about 130°C to 180°C.

1               8.     The process according to claim 1 further comprising forming a pad  
2 oxide layer between said semiconductor substrate and said silicon nitride layer before  
3 forming said silicon nitride layer.

1               9.     The process according to claim 1 further comprising an ion drive-in  
2 procedure after forming said trench-fill layer to fill said trench and deposit on said oxide  
3 layer.

1               10.    The process according to claim 9 wherein said ion drive-in procedure  
2 is performed at a temperature of about 800°C to 1,000°C.

1               11.    A process for producing a trench-type semiconductor device, the  
2 process comprising:

3               providing a semiconductor device including an oxide layer disposed on a  
4 silicon nitride layer which is disposed on a semiconductor substrate, and a trench extending  
5 through said oxide layer and said silicon nitride layer and partially through said  
6 semiconductor substrate, said silicon nitride layer protruding from sidewalls of said trench;  
7               performing an etching procedure having a higher selectivity for said silicon  
8 nitride layer than for said oxide layer sufficient to remove portions of said silicon nitride  
9 layer protruding from said sidewalls of said trench to form substantially even sidewalls of  
10 said trench; and

11              forming a trench-fill layer to fill said trench and deposit on said oxide layer.

1               12.    The process according to claim 11 wherein said etching procedure is a  
2 wet-etching procedure.

1               13.    The process according to claim 12 wherein said wet-etching procedure  
2 is performed by an etchant with a selectivity of silicon nitride layer to oxide layer of at least  
3 about 10.

1               14.    The process according to claim 13 wherein said etchant has a  
2 selectivity of silicon nitride layer to oxide layer ranging from about 50 to 100.

1               15.    The process according to claim 12 wherein said wet-etching procedure  
2 is performed for about 100 to 200 seconds.

1                   16.     The process according to claim 12 wherein said etchant comprises a  
2 phosphoric acid solution.

1                   17.     The process according to claim 12 wherein said wet-etching procedure  
2 is performed at a temperature of about 130°C to 180°C.

1                   18.     The process according to claim 11 wherein said semiconductor device  
2 further comprises a pad oxide layer between said semiconductor substrate and said silicon  
3 nitride layer.

1                   19.     The process according to claim 11 further comprising an ion drive-in  
2 procedure after forming said trench-fill layer to fill said trench and deposit on said oxide  
3 layer.

1                   20.     The process according to claim 19 wherein said ion drive-in procedure  
2 is performed at a temperature of about 800°C to 1,000°C.

1                   21.     The process according to claim 11 wherein said trench-type  
2 semiconductor device comprises a PMOS.

1                   22.     The process according to claim 11 wherein said trench-fill layer  
2 comprises polysilicon.